

## CREATIONS\_Report of an Implementation Activity: Artful Physics

**Project Reference:** H2020-EU.5., H2020-EU.5.a.  
Project reference: 665917  
**Code:** D

**Version & Date:** 23/09/2016 Draft 1

**Editing:** Elizabeth Cunningham

**Approved by:** UoB, Exeter, STFC

**Process Owner:** STFC

Short Description: Artful Physics

CREATIONS National Competition for UK primary and secondary school students inviting them to create an artistic piece that engages young people in physics and astronomy and inspires future scientists. The competition has been launched and is ongoing.

List of Recipients: Public Document

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## Overview

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| <b>CREATIONS<br/>Event Code</b>                       | [UK08-050916]                                                  |
| <b>Title</b>                                          | Artful Physics                                                 |
| <b>Country City/Region</b>                            | UK - National                                                  |
| <b>Working language</b>                               | English                                                        |
| <b>Start-End Date</b>                                 | [05/09/2016]-[30/04/2017]                                      |
| <b>Organizing Institute</b>                           | STFC                                                           |
| <b>Coordinator name/email</b>                         | Elizabeth Cunningham elizabeth.cunningham@stfc.ac.uk           |
| <b>CREATIONS Partners<br/>that were also Involved</b> | UoB, Exeter, HSRW                                              |
| <b>Activity Form</b>                                  | Competition                                                    |
| <b>Activity Type</b>                                  | National competition for primary and secondary school students |
| <b>Total number of teachers</b>                       | Unknown at this time, estimate: 100                            |
| <b>Total number of students</b>                       | Unknown at this time, estimate: 300                            |
| <b>Total number of schools</b>                        | Unknown at this time, estimate: 100                            |
| <b>Names of participating<br/>schools</b>             | Unknown at this time, estimate: 100 schools.                   |

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|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Website</b>                           | <a href="http://creations-project.eu/creations-competition-2016/">http://creations-project.eu/creations-competition-2016/</a>                                                                                                                                                                                     |
| <b>Photos or other relevant material</b> | <p>Flyer and Poster available on website:<br/> <a href="http://creations-project.eu/creations-competition-2016/">http://creations-project.eu/creations-competition-2016/</a></p> <p>Additional content also posted on TES.com Community Forum - Subject: Science. Search for the 'CREATIONS competition 2016'</p> |
| <b>Event agenda</b>                      | N/A                                                                                                                                                                                                                                                                                                               |

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## 1. Preparation

In order to launch the competition the following activities were completed:

Competition project plan – UoB, Exeter, STFC  
Poster and Flyer content – UoB, Exeter, STFC  
Poster and Flyer design and production – STFC  
Advertising – UoB, Exeter, STFC  
Website content - STFC  
Website design – HSRW  
TES forum content – UoB, Exeter, STFC  
TES forum set up and management – Exeter  
The competition was launched on 5<sup>th</sup> September 2016.

## 2. Brief description

Artful Physics is a national competition for UK primary and secondary school students inviting them to create an artistic piece that engages young people in physics and astronomy and inspires future scientists.

The demonstrator's main aim is to give pupils across a wide age range the opportunity to create a piece of art work that explains a key concept in physics. By doing so, they will both enhance their understanding of physics and develop their interest in an element of physics beyond the possibilities available within class time, whilst developing their artistic understanding and skill. The final stage of the competition involves prize winner events hosted by RAL/STFC with a 'money-can't-buy' prize (e.g. firing the RAL laser).

## 3. Learning outcomes

Learning activities in terms of CREATIONS Approach – written by the University of Exeter

| IBSE Activity                                                                                  | Interaction with CREATIONS Features                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Student (Teacher)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Potential arts activity |
|------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------|
| <b>Phase 1:</b><br><b>QUESTION:</b><br>students investigate a scientifically oriented question | Students pose, select, or are given a scientifically oriented question to investigate. <i>Balance and navigation</i> through <i>dialogue</i> aids teachers and students in creatively navigating educational tensions, including between open and structured approaches to IBSE. Questions may arise through <i>dialogue</i> between students' scientific knowledge and the scientific knowledge of professional scientists and science educators, or through <i>dialogue</i> with different ways of knowledge inspired by <i>interdisciplinarity</i> and personal, embodied learning. <i>Ethics and trusteeship</i> is an important consideration in experimental design and collaborative work, as well as in the initial choice of question. | Children and young people will choose an art form to best represent their science topic, perhaps using IBSE. This is however unlikely to map directly onto the IBSE stages to the left, but to encompass science knowledge/processes in a more holistic way e.g. through a film with narrative; through a dance performance embodying a science concept, through a poem engaging with key physics principles.<br><br>They may ask teachers for assistance if they are available but are also likely to draw on artist/scientist expert mentoring via the competition website. |                         |
| <b>Phase 2:</b><br><b>EVIDENCE:</b><br>students give priority evidence to                      | Students determine or are guided to evidence/data, which may come from <i>individual, collaborative and communal activity</i> such as practical work, or from sources such as data from professional scientific activity or from other contexts. <i>Risk, immersion and play</i> is crucial in <i>empowering</i> pupils to generate, question and discuss evidence.                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                         |
| <b>Phase 3:</b><br><b>ANALYSE:</b><br>students analyse evidence                                | Students analyse evidence, using <i>dialogue</i> with each other and the teacher to support their developing understanding.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                         |

|                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                    |  |
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| <b>Phase 4:</b><br><br><b>EXPLAIN:</b><br>students formulate an explanation based on evidence        | Students use evidence they have generated and analysed to consider <i>possibilities</i> for explanations that are original to them. They use argumentation and <i>dialogue</i> to decide on the relative merits of the explanations they formulate, <i>playing</i> with ideas.                                                                                                                                     |  |
| <b>Phase 5:</b><br><br><b>CONNECT:</b><br>students connect explanations to scientific knowledge      | Students connect their explanations with scientific knowledge, using <i>different ways of thinking and knowing</i> ('knowing that', 'knowing how', and 'knowing this') to relate their ideas to both disciplinary knowledge and to <i>interdisciplinary</i> knowledge to understand the origin of their ideas and reflect on the strength of their evidence and explanations in relation to the original question. |  |
| <b>Phase 6:</b><br><br><b>COMMUNICATE:</b><br>students communicate and justify explanation           | Communication of <i>possibilities</i> , ideas and justifications through <i>dialogue</i> with other students, with science educators, and with professional scientists offer students the chance to test their new thinking and experience and be <i>immersed</i> in a key part of the scientific process. Such communication is crucial to an <i>ethical</i> approach to working scientifically.                  |  |
| <b>Phase 7:</b><br><br><b>REFLECT:</b><br>students reflect on the inquiry process and their learning | <i>Individual, collaborative and community-based</i> reflective <i>activity for change</i> both consolidates learning and enables students and teachers to balance educational tensions such as that between open-ended inquiry learning and the curriculum and assessment requirements of education.                                                                                                              |  |

## 4. Photos of the activity or other relevant material

This activity has not yet been completed, all material used to advertise the competition is available on the website: <http://creations-project.eu/creations-competition-2016/>

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## 5. Event Agenda

N/A

## 6. Evaluation

We will be using the obligatory teacher and student questionnaires as defined in deliverable 6.3, repurposed for the UK. The data will be gathered in the form of an online survey - all competition participants will be asked to complete once they have submitted their entry.

## 7. Annex

N/A

## CREATIONS Report of Particle Physics Masterclass Implementation Activity

**Project Reference:** H2020-EU.5., H2020-EU.5.a.  
Project reference: 665917

**Code:** D

**Version &  
Date:** v1, 22  
**September  
2016**

**Editing:** Dr Maria  
Pavlidou, Dr  
Kostas  
Nikolopoulos

**Approved by:**  
Prof Cristina  
Lazzeroni,  
Ms Lynne Long,  
STFC, Exeter

**Process Owner:**  
UoB

Short Description: The particle physics masterclass gives the opportunity to A level students to understand how particle collisions at CERN allow physicists to identify new particles and measure important physical characteristics of fundamental particles of matter.

List of Recipients: Public Document

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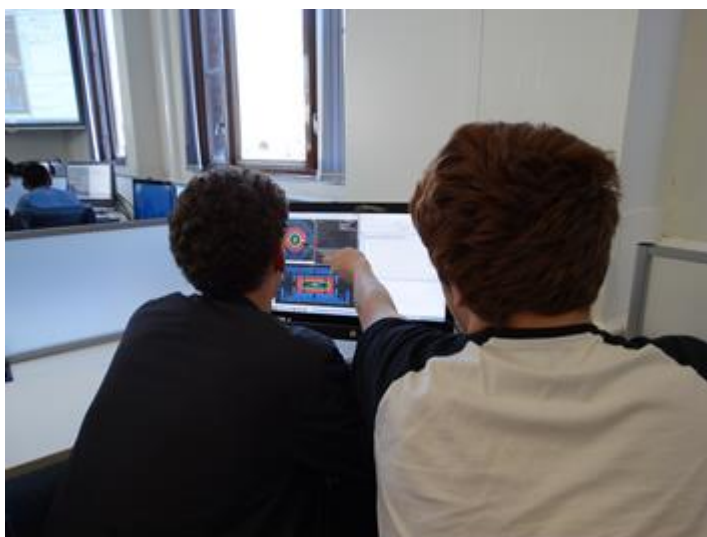
## Overview

|                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CREATIONS Event Code</b>                       | [ UKUoB-210916]                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Title</b>                                      | Particle Physics Masterclass                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Country City/Region</b>                        | UK, Birmingham, Midlands                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Working language</b>                           | English                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Start-End Date</b>                             | [01/09/2015]-[30/08/2018]                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Organizing Institute</b>                       | University of Birmingham, School of Physics and Astronomy                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Coordinator name/email</b>                     | <i>M.Pavlidou@bham.ac.uk</i>                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>CREATIONS Partners that were also Involved</b> | STFC, CERN                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Activity Form</b>                              | Whole day activity including workshops and lectures                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Activity Type</b>                              | <p><b>Local activities:</b> particle physics masterclasses in schools or at the UoB with secondary students of ages 16-18 as audience.</p> <p><b>National activities:</b> particle physics masterclasses in UK schools with secondary students of ages 16-18 as audience.</p> <p><b>International activities:</b> Training workshop for UK and international school teachers on how to use the MINERVA resources at the ASE 2016 conference in UoB.</p> |
| <b>Total number of teachers</b>                   | 11 teachers (3 international and 8 from the UK) have been trained to run the workshop; an additional 60 teachers observed the workshop and participated in some form                                                                                                                                                                                                                                                                                    |
| <b>Total number of students</b>                   | 290 (national and local)                                                                                                                                                                                                                                                                                                                                                                                                                                |

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Total number of schools</b>        | 26 (national and local)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Names of participating schools</b> | <p>Abbot Beyne,<br/>King Edward VI College in Stourbridge,<br/>Barr Beacon School,<br/>North Shropshire College (NSC),<br/>Lordswood Sixth Form<br/>Edgbaston High School for Girls<br/>King Edward VI Five Ways<br/>The Royal Wolverhampton School<br/>Malvern College<br/>Chace Community School,<br/>Enfield County School,<br/>Edmonton County School,<br/>Bishop Stopford's School,<br/>Aylward Academy,<br/>Enfield Grammar School<br/>Guilsborough Academy,<br/>Shrewsbury School,<br/>Harborne Academy,<br/>Holyhead school,<br/>King Edward VI High School,<br/>Waverley School,<br/>Akeley Woods School,<br/>King Edward VI High School for Girls</p> |

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|                                          |                                                                                                                                                                                                                                                                                                      |
|------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                          | <p>Campion School</p> <p>Wood Green Academy</p> <p>Alcester Grammar</p>                                                                                                                                                                                                                              |
| <b>Website</b>                           | <a href="http://www.birmingham.ac.uk/schools/physics/outreach/Secondary-Schools/particle-physics-masterclasses.aspx">http://www.birmingham.ac.uk/schools/physics/outreach/Secondary-Schools/particle-physics-masterclasses.aspx</a>                                                                  |
| <b>Photos or other relevant material</b> | <p>Included below</p>                                                                                                                                                                                                                                                                                |
| <b>Event agenda</b>                      | <p>The work has been published at "Learning with ATLAS at CERN" (Long, L. Phys. Educ 46 (2011) 270-280).</p> <p>Updates of the resources are being provided by the International Particle Physics Outreach Group <a href="http://physicsmasterclasses.org/">http://physicsmasterclasses.org/</a></p> |







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## 8. Preparation

The main preparation before the event is the uploading of the electronic resources of the MINERVA event analysis software and providing access-accounts to the students. Postgraduate student helpers are also briefed on the use of the resources.

## 9. Brief description

Information is given in detail on the relevant web site.

## 10. Learning outcomes

Students learn how particle physicists use software analysis to recognize the type of particles which are present in a collision. They also learn how to use the software tool MINERVA to calculate certain parameters of the events e.g. energy, momentum, mass of fundamental particles, ratio of types of collisions etc.

## 11. Photos of the activity or other relevant material

See above

## 12. Event Agenda

### Schedule of the Day

**From 9.30 Arrival and welcome in Bridge Study Room (2<sup>nd</sup> floor, Poynting Building)**  
Free tea/coffee/juice available

**10.30 - 12.00 Talks in the Learning Centre (Room UG09)**  
Talk 1 Introduction to Particle Physics & Accelerators (Prof DE)  
Talk 2 The ATLAS Experiment at the Large Hadron Collider (JK)  
Talk 3 Introduction to MINERVA - investigating ATLAS events (DB)

**12.00 – 13.30 Computing activity in Room P09 (Ground floor, Poynting Building)**  
Recognising different particles and collisions in ATLAS – an opportunity to use computer software to gain insights into detector technology and research techniques.

**13.30 – 14.10 LUNCH in the Bridge Study Room (2<sup>nd</sup> floor, Poynting Building)**  
Lunch is available to purchase on campus or students can bring a packed lunch.

**14.10 – 14.25 Discussion on the Physics Measurements in the Bridge Study Room**

Announcement of Results from the morning's computer activities.

**14.25 – 14.55 Small Group Discussions in the Bridge Study Room**

Break up into small discussion groups, led by a particle physics researcher.

**15.00 - 16.00 Live link to CERN in Poynting Building Small Lecture Theatre (S06)**

Discussion with physicists at CERN and other schools

**16:00 Departures**

|                                                                                   |                                                                                    |
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## 6 Evaluation

Questionnaires after the masterclass are given to students and to teachers. Evaluation shows that all students feel challenged and the vast majority of students enjoy this challenge. It also shows that for many students this activity triggers the thought of a possibility to study physics at a university level. Detailed feedback available on request.

## 7 Annex

N/A

## CREATIONS Report of Particle Physics Workshop Implementation Activity

**Project Reference:** H2020-EU.5., H2020-EU.5.a.  
Project reference: 665917

**Code:** D

**Version &  
Date:** v 1, 21  
Sep 2016

**Editing:** Dr Maria  
Pavlidou,  
Prof Cristina  
Lazzeroni

**Approved by:**  
Dr Kostas  
Nikolopoulos,  
Ms Lynne Long,  
STFC, Exeter

**Process Owner:**  
UoB

Short Description: The particle physics workshop introduces the world of particles to primary school children through interactive games and creative model making.

List of Recipients: Public Document

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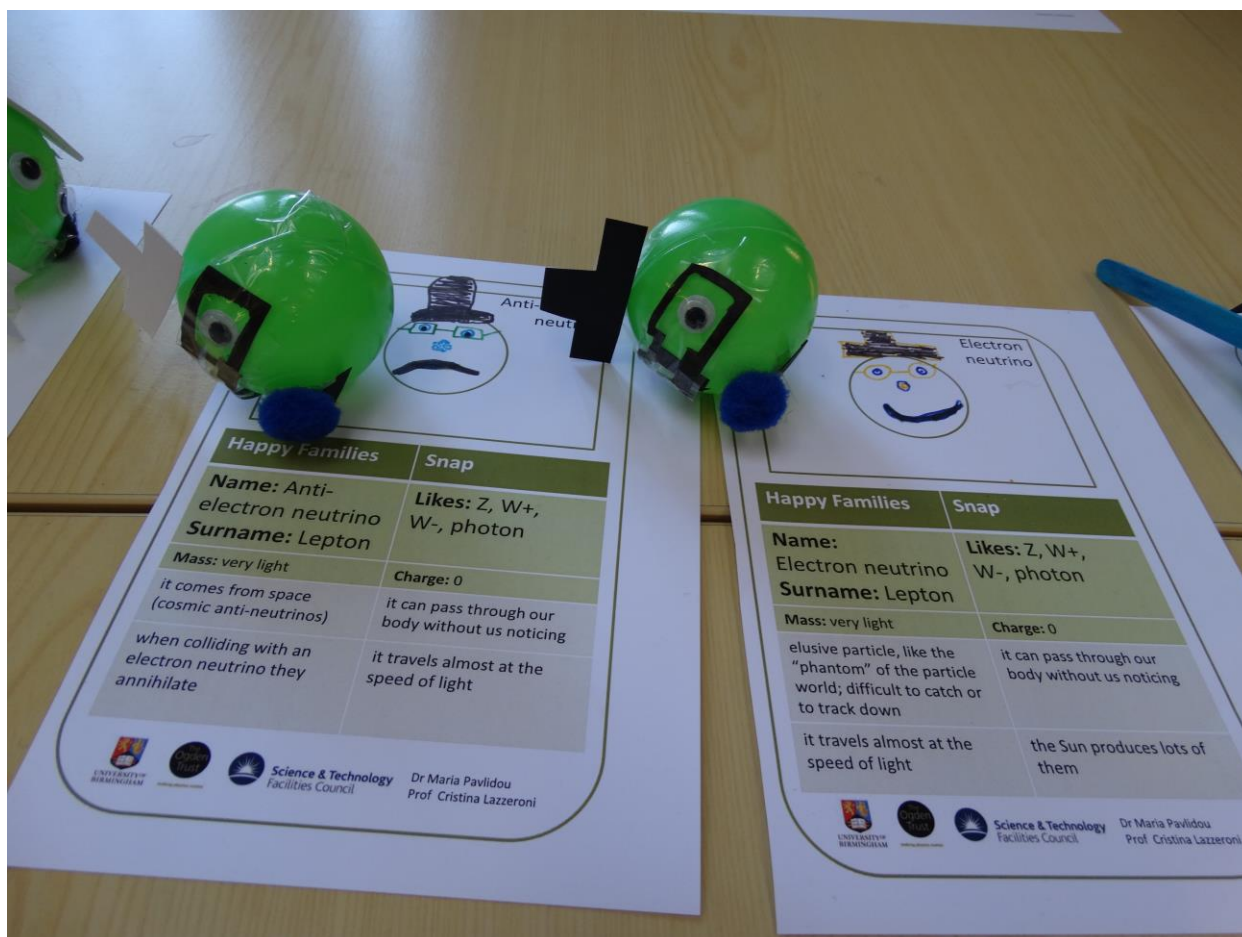
## Overview

|                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>CREATIONS Event Code</b>                       | [UKUoB-210916]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>Title</b>                                      | Particle Physics Workshop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Country City/Region</b>                        | UK, Birmingham, Midlands                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Working language</b>                           | English                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Start-End Date</b>                             | [01/09/2015]-[30/08/2018]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Organizing Institute</b>                       | University of Birmingham, School of Physics and Astronomy                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>Coordinator name/email</b>                     | <i>M.Pavlidou@bham.ac.uk</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>CREATIONS Partners that were also Involved</b> | CERN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Activity Form</b>                              | workshop                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Activity Type</b>                              | <p><b>Local activities:</b> particle physics workshops in schools or at the UoB with primary students as audience.</p> <p><b>National activities:</b> Training workshops at UoB for outreach officers of other UK Universities in order to show them how to run the workshop.</p> <p><b>International activities:</b> Training workshop for UK and international primary school teachers on how to use the resources at the ASE 2016 conference in UoB. Training Greek primary school teachers at CERN as part of the Playing with protons training course 2016.</p> |
| <b>Total number of teachers</b>                   | 35 (14 international, 21 national) teachers and outreach officers have been trained to run the workshop; an additional 50 teachers observed the workshop and participated in some form                                                                                                                                                                                                                                                                                                                                                                               |

|                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Total number of students</b>       | 460 (all local, wider area Midlands)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Total number of schools</b>        | 22 (all local, wider area Midlands)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>Names of participating schools</b> | <p>Welford on Avon Primary</p> <p>St Catharine's RC Primary</p> <p>St James &amp; Ebrington</p> <p>Mickleton</p> <p>St David's, Moreton in Marsh</p> <p>Dormer House , Moreton in Marsh</p> <p>St Mary's RC, Broadway</p> <p>St Michael's</p> <p>Forestdale</p> <p>Kings Norton Primary</p> <p>Northfield Manor</p> <p>Woodcock Hill</p> <p>Hillmorton Primary School</p> <p>Dunchurch Junior School</p> <p>Timberley</p> <p>Heathlands</p> <p>Colebourne</p> <p>Hillstone</p> <p>Brownmead</p> <p>Our Lady's</p> <p>Edgbaston High School for Girls Primary</p> <p>Malvern College</p> |

|                                          |                                                                                                                                                                                                                             |
|------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Website</b>                           | <a href="http://www.birmingham.ac.uk/schools/physics/outreach/Primary-Schools/MiniParticlePhysicsWorkshops.aspx">http://www.birmingham.ac.uk/schools/physics/outreach/Primary-Schools/MiniParticlePhysicsWorkshops.aspx</a> |
| <b>Photos or other relevant material</b> | Included below                                                                                                                                                                                                              |
| <b>Event agenda</b>                      | The work is currently in the process of being published. The authors would like to encourage more CREATIONS partners to use the resources, as long as they credit the authors.                                              |









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### **13. Preparation**

The only preparation needed before the workshop is the purchase and printing of resources that will be used during the workshop.

### **14. Brief description**

Information is given in detail on the relevant web site.

### **15. Learning outcomes**

Short term learning outcomes: Where is CERN and what it is and what it does; what does a particle accelerator do; why do we smash particles together; what are the smallest matter constituents we know of; the families of particles and their common / different characteristics; what is antimatter; how particles behave.

Long term learning outcomes: scientific knowledge evolves with time because of new discoveries; scientists test their theories with experiments; the smallest constituents of matter we know of are called elementary particles; science is for everyone and all can have a role in it; science is not secretive and it relates to everyday life; modern science is a team, collaborative effort.

### **16. Photos of the activity or other relevant material**

See above

### **17. Event Agenda**

The work is currently in the process of being published. The authors would like to encourage more CREATIONS partners to use the resources, as long as they credit the authors.

#### Typical Plan of the day

10:00-10:30      arrival & welcome

|             |                                                                |
|-------------|----------------------------------------------------------------|
| 10:30-11:30 | demonstration talk                                             |
| 11:30-11:45 | 15 minutes break                                               |
| 11:45-12:15 | workshop 1 – particle models                                   |
| 12:15-13:15 | lunch & University Campus Tour                                 |
| 13:15-13:45 | workshops 2 – particle interactions                            |
| 13:45-14:15 | student presentation of their work to the rest of the audience |

## Evaluation

Questionnaires after the workshop are given to students and to teachers. Evaluation shows short and long term learning outcomes and high success rate/enjoyment of students in the workshop.

**Project Reference:** H2020-EU.5., H2020-EU.5.a.  
Project reference: 665917

**Editing:** Ms Mairi Pardalaki  
Dr Kostas Nikolopoulos,  
Dr Maria Pavlidou,

**Code:** D

**Approved by:** STFC, Exeter

**Version & Date:** v1, 22 September 2016

**Process Owner:** UoB

Short Description: The Neutrino Passoire gives the opportunity to a wide range of audiences from primary school students to the general public to understand the nature of neutrinos, and of particles in general, their interactions and how they change their characteristics, through dance improvisation and discussion.

List of Recipients: Public Document

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## Overview

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| <b>CREATIONS Event Code</b>                       | [ UKUoB-200316]                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>Title</b>                                      | Neutrino Passoire                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>Country City/Region</b>                        | UK, Birmingham, Midlands                                                                                                                                                                                                                                                                                                                                                                          |
| <b>Working language</b>                           | English                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Start-End Date</b>                             | [20/03/2016]-[30/08/2018]                                                                                                                                                                                                                                                                                                                                                                         |
| <b>Organizing Institute</b>                       | University of Birmingham, School of Physics and Astronomy                                                                                                                                                                                                                                                                                                                                         |
| <b>Coordinator name/email</b>                     | <a href="mailto:k.nikolopoulos@bham.ac.uk">k.nikolopoulos@bham.ac.uk</a>                                                                                                                                                                                                                                                                                                                          |
| <b>CREATIONS Partners that were also Involved</b> | n/a                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Activity Form</b>                              | Session 1: 2h to 1/2 day<br>Session 2: 1 hour 30 min (+1 hour 30min for the preparation of the performance)                                                                                                                                                                                                                                                                                       |
| <b>Activity Type</b>                              | <p><b>Local activities:</b> workshops at primary schools for ages 8-13 (Session 1), and dance performance/discussion at larger venues (Session 2).</p> <p><b>National activities:</b> primary school dance festival (Session 1), or dance performance in national arts or science festivals.</p> <p><b>International activities:</b> Participation in international art or science festivals.</p> |

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| <b>Total number of teachers</b>          | The performance was attended by 38 people in the audience, that also stayed along for the subsequent discussion.                                                                                                                          |
| <b>Total number of students</b>          | n/a                                                                                                                                                                                                                                       |
| <b>Total number of schools</b>           | n/a                                                                                                                                                                                                                                       |
| <b>Names of participating schools</b>    | The event took place at the University of Birmingham in the context of the Arts and Science Festival 2016.                                                                                                                                |
| <b>Website</b>                           | <a href="http://www.birmingham.ac.uk/events/arts-and-science/arts-and-science-2016/Performances/neutrino-passoire.aspx">http://www.birmingham.ac.uk/events/arts-and-science/arts-and-science-2016/Performances/neutrino-passoire.aspx</a> |
| <b>Photos or other relevant material</b> | Included below                                                                                                                                                                                                                            |
| <b>Event agenda</b>                      | Session 2 of the demonstrator has been show-cased at the University of Birmingham Arts and Science festival. The performance programme is given below.                                                                                    |

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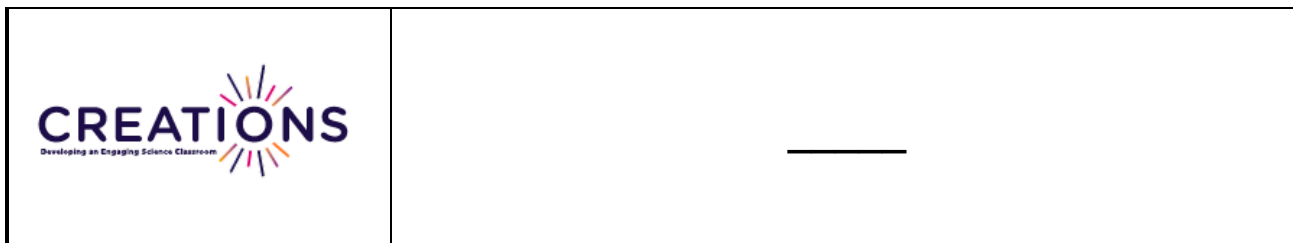


## 1. Preparation

No preparation needed for the audience before the performance (Session 2) for the workshop (Session 1) the only preparation needed is the purchase and printing of resources that will be used during the workshop.

## 2. Brief description

Inspired by the latest 2015 Nobel Prize in Physics, "for the discovery of neutrino oscillations, which shows that neutrinos have mass", the team started working on this elusive and omnipresent particle: The journey from its birthplace, the Sun, to the universe, while oscillating among the three flavours and traversing ordinary matter, like the Earth and our bodies.



These oscillations — where the neutrino forgets and remembers its identity — and the minimal interactions — penetrating matter with no trauma or memory of the event itself — led the artists to reconsider the image of the human body; not as an impregnable and over-sacred fortress as it is often thought of, but as a sort of a colander [(fr.) passoire], open to the outside world. This naturally led to the questioning of the notion of borders, where the team let the neutrinos give the answer.

The Neutrino Passoire was presented in March 2016 as part of the University of Birmingham Arts & Science Festival in a fully-booked auditorium, receiving overwhelmingly positive feedback. A short video teaser of the performance can be found at: <https://www.youtube.com/watch?v=QmlNAHwQ4tM>

### **3. Learning outcomes**

The audience by the end of Session 2, should be able to appreciate the subtleties of the microcosm, and how particles interact or change from one to another. The subsequent Q&A session here is even more important, not only to support their inquiries/curiosity, but also to correct any possible misconceptions.

### **4. Photos of the activity or other relevant material**

See above

### **5. Event Agenda/Programme**



See performance programme below



## The Neutrino Passoire

The 2015 Nobel Prize in physics was awarded "for the discovery of neutrino oscillations, which shows that neutrinos have mass".

The elusive and omnipresent neutrinos are born in the Sun, travelling through space and oscillating between flavours imperceptibly. They pass through matter, the Earth, our bodies, continuing their journey.

This performance is a collaboration between particle physicists at the University of Birmingham and dancers Mairi Pardalaki and Fanny Travaglino, alongside with musician Katerina Fotinaki. Together they explore the fact that the human body is finally not a fortress as impregnable and over-sacred as we might think; it is rather perceived as a sort of a colander (passoire in French), letting neutrinos pass through without trauma or memory of the event itself. This is a starting point, to question the notion of borders, always relevant, and let the neutrinos give the answers.

Costumes are created by Anaïs Lelièvre and the video animation is by Marcel Reinhard.

Prepared in the context of the University of Birmingham Arts and Science Festival 2016



Mairi Pardalaki is born in Athens, Greece. A student of Maurice Bejart's soloist Daniel Lommel, she then moves to Paris to pursue her dance studies beside Wilfride Prollet, Peter Goss and Nina Dipla. In parallel, she finishes her Communication Degree. She dances at "Kyma" by Nina Dipla and she co-creates the dance-theatre piece "Petite Marquise" with Hélène Gautier and Francesca Saraullo. In 2012, she joins Maria Yannaros for the piece "Arachnées", notably passing from the Avignon Festival. Together they create Ahtenysti Company. She meets fine artist Anaïs Lelièvre in 2013 with whom she starts a series of performances named "CLOC". In 2015 she participates at the new work "Moses und Aron" by Romeo Castellucci at the Paris Opera.

Mairi has been teaching yoga, certified by the French Yoga Federation.

Fanny Travaglino studies circus at ENACR (French National School of Circus). She then pursues her studies in contemporary dance in Barcelona. She creates her solo "Chut", a piece for children "Pas à Pages" and "Pieds Tracés", a sketching dance performance. In 2008 she sets up a festival around short forms of movement called "A pas de corps". Continuing her research on words, their meanings and sounds she creates a short play called "Son Sang" in 2011. That same year she assists Luciano Travaglino in his staging of "Uccellacci Uccellini". She creates her company EAU ID A in 2012, on the occasion of creating "Forbidden Drowning". In 2013 the company becomes an associate artist at the Théâtre de la Girandole. In 2014 she stages a musical poetry piece "Je t'aime, un aparté qui a du corps". As a result of their work together in "Je t'aime", she is joined by Pauline Ziadé to co-lead the company. In 2015 she writes and dances in "Objection!", a piece of poetic objects.



Born in Athens, Katerina Fotinaki studies Classical Literature at the University of Athens and Vocal Technique at the Institute of Vocal Arts, under the Baryton Spyros Sakkas. She undertakes the artistic direction of many projects in Greece, most of them for children and receives many prizes in Composition Contests. She leaves her country in 2006 and moves to Paris, invited by the composer Angelique Ionatos and creates 3 different shows with her as well as a CD/DVD of their duet. She stays many years as a resident of "Cité des Arts".

In 2011 she wins the 1st prize for the National Songwriting Contest in Athens, and begins her solo discographic career with the disc "TITZAKA (Accords Croisés / Harmonia Mundi)" that is being received with enthusiasm by the french press (Télérama Music Magazine, and chosen by Le Monde as the 4th best disc of the year 2014). She is performing a big tour with this repertoire along with other collaborations and performances. In addition to the music and the poetry of her country, Katerina Fotinaki has a great love for contemporary music and studies it with the composer Bernard Cavanina at the Gennevilliers Conservatory.

Since 2014 she is teaching at the National Theater of Northern Greece.

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## 6. Evaluation

Questionnaires after the performance are given to the audience. Evaluation shows that the audience has understood the basic ideas behind neutrino oscillations, and that they enjoyed the process through the performance.

## 7. Annex

N/A